WHAT IS CLAIMED IS:

1. A method of removing free-carbon from a silicon carbide component of a semiconductor substrate processing apparatus, the silicon carbide component being porous and including an interior and an exposed surface, the silicon carbide component including free-carbon in the interior and on the exposed surface, the method comprising treating the silicon carbide component to remove at least substantially all of the free-carbon on the exposed surface.

2. The method of Claim 1, wherein the silicon carbide component is made by reaction synthesis of silicon vapor with carbon.

3. The method of Claim 1, wherein the treating comprises heating the silicon carbide component in an oxygen-containing atmosphere at a temperature and for an amount of time effective to remove substantially all of the free-carbon from at least the exposed surface.

4. The method of Claim 3, wherein the temperature is from about 750°C to about 1200°C, or from about 800°C to about 900°C, and the amount of time is from about 2 hours to about 12 hours.

5. The method of Claim 1, wherein the treating comprises contacting the silicon carbide component with a chemical solution that is effective to remove substantially all of the free-carbon from at least the exposed surface without substantially removing the silicon carbide.

6. The method of Claim 1, wherein the treatment comprises treating the silicon carbide component with an oxygen plasma to remove substantially all of the free-carbon from at least the exposed surface.

7. The method of Claim 1, further comprising conditioning the exposed surface of the silicon carbide component with plasma after the treating.

8. The method of Claim 1, wherein the free-carbon is in the form of carbon particles and/or carbon clusters and the treating removes at least about 90% of a number of carbon particles and/or carbon clusters having a size of at least about 50 μm in the interior of the silicon carbide component.

9. The method of Claim 1, wherein the silicon carbide component consists essentially of silicon carbide and the free-carbon.

10. The method of Claim 1, wherein the silicon carbide component is selected from the group consisting of a baffle plate of a showerhead electrode assembly, plasma confinement ring, edge ring, focus ring, backing plate, chamber liner, electrode, wafer passage insert, window, plasma screen, and a chamber wall.

11. A silicon carbide component of a semiconductor substrate processing apparatus, the silicon carbide component being porous and comprising an interior and an exposed surface, the silicon carbide component having been (i) made by a process that results in the silicon carbide component including free-carbon in the interior; (ii) treated to produce an exposed surface having free-carbon therein; and (iii) treated to remove the free-carbon such that at least the exposed surface is substantially free of the free-carbon.

12. The silicon carbide component of Claim 11, wherein the silicon carbide component is selected from the group consisting of a baffle plate, a plasma confinement ring, edge ring, focus ring, backing plate, chamber liner, electrode, wafer passage insert, window, plasma screen, and a chamber wall.

13. A semiconductor substrate processing apparatus comprising a plasma processing chamber and at least one silicon carbide component according to Claim 11 in the plasma processing chamber.

14. The semiconductor substrate processing apparatus of Claim 13, wherein the plasma processing chamber is an etching chamber.

15. A method of processing a semiconductor substrate in a plasma processing chamber of a semiconductor substrate processing apparatus into which process gas is supplied by a showerhead electrode assembly including a showerhead electrode, a baffle chamber through which process gas passes to the showerhead electrode, and a silicon carbide baffle plate according to Claim 12 in the baffle chamber, the method comprising:

placing a production semiconductor substrate on a substrate support in the plasma processing chamber;

supplying process gas into the baffle chamber, the process gas passing through the silicon carbide baffle plate into a space between the silicon carbide baffle plate and the showerhead electrode followed by passing through the showerhead electrode and into an interior of the plasma processing chamber; and

processing the production semiconductor substrate with the process gas passing through the showerhead electrode.

16. The method of Claim 15, further comprising etching a layer of dielectric material on the production semiconductor substrate by supplying RF power to the showerhead electrode such that the process gas forms a plasma in contact with an exposed surface of the semiconductor substrate.

17. The method of Claim 15, further comprising plasma conditioning the plasma processing chamber prior to placing the production semiconductor substrate on the substrate support in the plasma processing chamber.

18. The method of Claim 17, wherein the plasma conditioning comprises successively processing dummy wafers in the plasma processing chamber before processing the production semiconductor substrate, wherein a number of adder particles having a size of at least about 0.2 μm deposited on the dummy wafers is less than about 20 after plasma conditioning the plasma processing chamber for up to about 2 RF hours.

19. The method of Claim 18, wherein the number of the adder particles having a size of at least about 0.2 μm deposited on the dummy wafers is less than about 10 after plasma conditioning the plasma processing chamber for up to about 2 RF hours.

20. The method of Claim 17, wherein the silicon carbide baffle plate is placed in the plasma processing chamber before plasma conditioning the plasma processing chamber.

21. A method of making a silicon carbide component of a semiconductor substrate processing apparatus, comprising:

making a silicon carbide component by a process that results in the silicon carbide component including free-carbon in an interior of the silicon carbide component;

removing a portion of the silicon carbide component to produce an exposed surface having free-carbon thereon; and

treating the silicon carbide component to remove at least substantially all of the free-carbon on the exposed surface.

22. The method of Claim 21, wherein the silicon carbide component is made by reaction synthesis of silicon vapor with carbon.

23. The method of Claim 21, wherein the treating comprises heating the silicon carbide component in an oxygen-containing atmosphere at a temperature and for an amount of time effective to remove substantially all of the free-carbon from at least the exposed surface.

24. The method of Claim 23, wherein the temperature is from about 750°C to about 1200°C, or from about 800°C to about 900°C, and the amount of time is from about 2 hours to about 12 hours.

25. The method of Claim 21, wherein the treating comprises contacting the silicon carbide component with a chemical solution that is effective to remove substantially all of the free-carbon from at least the exposed surface without substantially removing the silicon carbide.

26. The method of Claim 21, wherein the treatment comprises treating the silicon carbide component with an oxygen plasma to remove substantially all of the free-carbon from at least the exposed surface.

27. The method of Claim 21, wherein the silicon carbide component is selected from the group consisting of a baffle plate, plasma confinement ring, edge ring, focus ring, backing plate, chamber liner, electrode, wafer passage insert, window, plasma screen, and a chamber wall.

28. The method of claim 21, wherein the removing comprises mechanically treating the silicon carbide component to remove silicon carbide therefrom.